MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018

TAI2151 – ARTIFICIAL INTELLIGENCE FUNDAMENTALS

(All Sections/Groups)

28 October 2017
9.00am – 11.00am
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **5** pages with **5** questions only.
2. Attempt **ALL FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the answer booklet provided.

Question 1

(a) *What is a Turing test? What is the most important premise/condition to pass the Turing test?* (2 marks)

(b) Compare reflex-based agent with goal-based agent. (2 marks)

(c) Imagine an automatic taxi driver agent whose job is to take a person to a location of that person's choice. The agent only drives to approved locations and only on special roads dedicated to it. The speed limit is the same for all roads. Traffic is not an issue as all roads are single lane in each direction and all traffic moves at the same speed. There are no issues related to sensing. The taxi driver agent is implemented using a goal-based architecture. The following is the PEAS description:

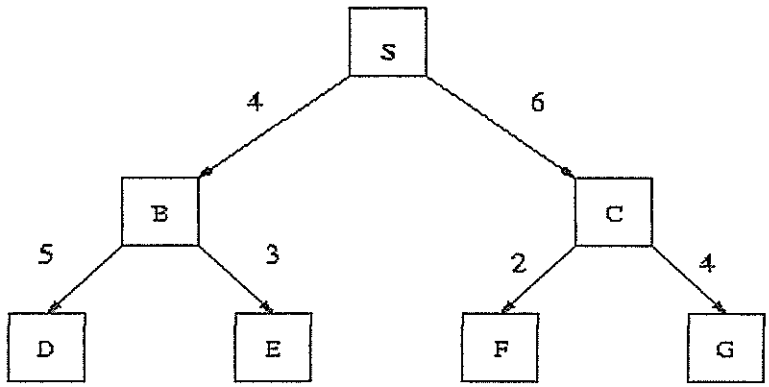
Performance: Get person to location, take shortest route
Environment: Client, enemies, other vehicles, roads
Actuators: Steering, accelerator, brake, speaker
Sensors: Camera, sonar, speedometer, GPS, voice input

Describe the environment with some justifications:
Is it fully or partially observable? (1 mark)
Is it deterministic or stochastic? (1 mark)
Is it static or dynamic? (1 mark)
Is it discrete or continuous? (1 mark)
Is it single or multi-agent? If multi-agent, who are the other agents and are the agent interactions competitive or cooperative? (2 marks)

Continued....

Question 2

Suppose that you need to find a path between S and G in the following graph. The number attached to each edge in the graph represents the actual distance of traversing the edge.



Assume also that the estimated distances to the goal are given by the following table:

Node:	S	B	C	D	E	F	G
Estimated Distance to G:	6	1	3	2	5	4	0

For each of the following search methods list the nodes in the order in which they are expanded by the search method while looking for a solution. As an illustration, the solution for Depth-Limited Search is provided below.

Depth-Limited Search (depth-limit = 2)
List: [S, B, C]

(a) Depth-First Search
List: _____ (2 marks)

(b) Breadth-First Search
List: _____ (2 marks)

(c) Uniform Cost Search
List: _____ (2 marks)

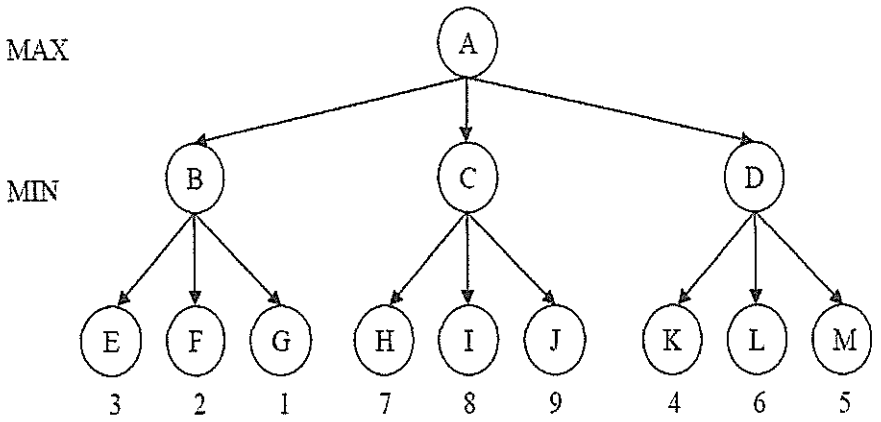
(d) Greedy Search
List: _____ (2 marks)

(e) A*
List: _____ (2 marks)

Continued....

Question 3

Consider this game tree where the root is a maximizing node, and children are visited left to right.



(a) Compute the minimax game value of nodes A, B, C, and D using the standard minimax algorithm. (2 marks)

(b) What move will be selected by player one using minimax? (1 mark)

(c) List the nodes (leaves or interior nodes) that alpha-beta algorithm prunes (i.e., decides need not be examined). (2 marks)

(d) The number of nodes that alpha-beta algorithm prunes depends on how each node's children are ordered in the tree. How to obtain a new game tree by re-ordering the children of each internal node, such that the new game tree is equivalent to the tree above, but alpha-beta pruning will prune as many nodes as possible? List the nodes that would be pruned.

(5 marks)

Continued....

Question 4

You are given the following predicates:

cat(X) = X is a cat
mammal(X) = X is a mammal
warm-blooded(X) = X is warm-blooded

(a) Translate the following English sentences into First-Order Logic statements using the predicates above:
(i) Pussy is a cat.
(ii) All cats are mammals.
(iii)All mammals are warm-blooded. (2 marks)

(b) Convert the First-Order Logic statements obtained in (a) into Conjunctive Normal Form. (2 marks)

(c) Use resolution refutation to prove that Pussy is warm-blooded. (6 marks)

Continued....

Question 5

A candy manufacturer interviews a customer on his willingness to eat a candy of a particular colour or flavour. The following table shows the collected responses:

Colour	Flavour	Edibility
Red	Grape	Yes
Red	Cherry	Yes
Green	Grape	Yes
Green	Cherry	No
Blue	Grape	No
Blue	Cherry	No

For your information, $log_2\ 1 = 0$, $log_2\ 2 = 1$, $log_2\ 3 = 1.6$, $log_2\ 4 = 2$, $log_2\ 5 = 2.3$
Also, $log(x/y) = log\ x - log\ y$

(a) What is the information content of the feature edibility, *I(Edibility)*? Show your work. (2 marks)

(b) What is the information content of the feature edibility knowing a particular colour, *I(Edibility | Colour)*? Show your work. (2 marks)

(c) Which feature (colour or flavour) has the larger mutual information with edibility? (2 marks)

(d) Draw the decision tree for predicting edibility that maximizes the information gain. (2 marks)

(e) Using your decision tree, what would you predict for the edibility of a blue coloured, and blueberry flavoured candy? (2 marks)

End of Paper